CLAIMS

1. A device to treat tissue, comprising:

an outer tube;

an inner tube disposed at least partially within the outer tube; and

a dual balloon including an inner balloon and an outer balloon, the inner balloon coupled to the inner tube at a proximal end and at a distal end, the outer balloon coupled to the inner tube at a distal end and to the outer tube at a proximal end, a first interior volume defined between the outer balloon and the inner balloon in fluid communication with an inlet in the volume between the outer tube and the inner tube.

2. The device of claim 1, wherein the inner tube further defines:

a guidewire lumen;

a supply lumen; and

a return lumen.

3. The device of claim 2, wherein the supply lumen defines a hole such that a fluid flowing in the supply lumen may be caused to flow into a volume defined by the inner balloon, and wherein the return lumen defines a hole such that a fluid flowing in a volume defined by the inner balloon may be caused to flow into the return lumen.

4. The device of claim 2, wherein the guidewire lumen extends from a proximal end of the inner tube to a distal end of the inner tube.

5. The device of claim 1, further comprising at least two radially extending tabs disposed around a circumference of the inner tube to substantially center the inner tube within the dual balloon.

6. The device of claim 1, further comprising at least one marker band disposed on the inner tube to locate a working region of the device at a desired location.

7. The device of claim 1, further comprising a source of chilled fluid having a supply tube and a return tube, the supply tube coupled in fluid communication to the supply lumen and the return tube coupled in fluid communication to the return lumen.

8. The device of claim 1, further comprising a source of fluid, the source of fluid coupled in fluid communication to the volume between the inner balloon and the outer balloon.

9. The device of claim 7, wherein the fluid is a perfluorocarbon.

10. The device of claim 9, wherein the fluid is Galden® fluid.

11. The device of claim 10, wherein the fluid is Galden® fluid HT-55.

12. The device of claim 8, wherein the fluid includes contrast media.

13. The device of claim 8, wherein the source of fluid includes a gear pump.

14. The device of claim 13, wherein the gear pump is one selected from the group consisting of a radial spur gear pump and a helical tooth gear pump.

15. A method of reducing restenosis after angioplasty in a blood vessel, comprising:

inserting a catheter into a blood vessel, the catheter having a balloon;

inflating the balloon with a perfluorocarbon such that an exterior surface of the balloon is in contact with at least a partial inner perimeter of the blood vessel, the perfluorocarbon having a temperature in the range of about -10°C to -50°C.

16. The method of claim 15, further comprising the step of disposing the catheter at a desired location using at least one marker band.

17. The method of claim 15, further comprising flowing the perfluorocarbon into the balloon using a supply lumen and exhausting the perfluorocarbon from the balloon using a return lumen.

18. The method of claim 15, wherein the balloon is a dual balloon, and further comprising providing a heat transfer fluid in the volume between the dual balloons.

19. The method of claim 18, wherein the heat transfer fluid includes a contrast media fluid.

20. The method of claim 15, further comprising disposing the catheter such that at least a portion of the balloon is in a coronary artery.

21. The method of claim 15, further comprising disposing the catheter such that at least a portion of the balloon is in a carotid artery.

22. A method of reducing atrial fibrillation, comprising:

inserting a catheter at least partially into the heart, the catheter having a balloon, a portion of the balloon located in the left atrium and a portion of the balloon located in a pulmonary vein;

inflating the balloon with a perfluorocarbon such that an exterior surface of the balloon is in contact with at least a partial circumference of the portion of the pulmonary vein adjacent the left atrium, the perfluorocarbon having a temperature in the range of about -10°C to -50°C.

23. The method of claim 22, wherein the balloon has a working region having a length of between about 5 mm and 10 mm.

24. The method of claim 22, further comprising:

inserting a wire capable of rupturing the atrial septum from the femoral vein into the right atrium;

forming a hole using the wire in the interatrial septum between the right atrium and the left atrium;

inserting a guide catheter into the right atrium;

inserting a guide wire through the guide catheter into the right atrium and further into a pulmonary vein;

disposing the catheter over the guidewire into a volume defined by the joint of the right atrium and the pulmonary vein.

25. A catheter system for vessel ablation, comprising:

a catheter shaft;

a warm balloon disposed on the catheter shaft, said warm balloon fluidically coupled to at least one lumen for inflating and deflating the warm balloon; and

a cold balloon disposed on the catheter shaft, said cold balloon fluidically coupled to two lumens for circulating a cold working fluid to and from the cold balloon, such that said cold balloon is located adjacent but proximal to said warm balloon.

26. The system of claim 25, wherein said warm balloon is made of silicone tubing.

27. The system of claim 26, wherein said warm balloon is secured by heat shrink tubing.

28. The system of claim 26, wherein said warm balloon is secured by an adhesive.

29. The system of claim 26, wherein said warm balloon is secured by bands.

30. The system of claim 29, wherein said bands are metal.

31. The system of claim 25, wherein said working fluid is a perfluorocarbon.

32. The system of claim 31, wherein said working fluid is Galden fluid.

33. The system of claim 25, wherein said warm balloon is structured and configured to anchor in a pulmonary vein.

34. The system of claim 33, wherein said cold balloon is structured and configured to be disposed partially in a pulmonary vein and partially in the left atrium.

35. The system of claim 34, wherein said cold balloon has a length of between about 1 to 2 ½ cm and a diameter of between about 1 to 2 ½ cm.

36. The system of claim 25, further comprising at least one marker band disposed within one or both of the cold balloon and the warm balloon.

37. The system of claim 25, further comprising a set of mapping electrodes disposed distal of the warm balloon.

38. The system of claim 25, further comprising an insulation sleeve disposed around the catheter shaft.

39. The system of claim 38, wherein the insulation sleeve is formed of a foamed extrusion.

40. The system of claim 25, further comprising a silicone sleeve disposed circumferentially about the catheter shaft adjacent a point at which at least one of the cold or warm balloons attaches to the catheter shaft.

41. The system of claim 25, wherein the cold balloon is doped with a biocompatible agent to promote heat transfer.

42. A method of reducing atrial fibrillation, comprising:
inserting a catheter at least partially into the heart, the catheter having a warm balloon and a cold balloon proximal of the warm balloon, at least a portion of the cold balloon located in the left atrium and at least a portion of the warm balloon located in a pulmonary vein;
inflating the warm balloon with a biocompatible fluid; and

inflating the cold balloon with a perfluorocarbon such that an exterior surface of the cold balloon is in contact with at least a partial circumference of the portion of the pulmonary vein adjacent the left atrium, the perfluorocarbon having a temperature in the range of about -10°C to -70°C.

43. The method of claim 42, wherein inflating the warm balloon includes pressurizing the warm balloon to a pressure of between about 1 to 2 atmospheres.

44. The method of claim 42, wherein inflating the cold balloon includes pressurizing the cold balloon to a pressure of between about 5 to 7 atmospheres.